

# Influence of Psychiatric Problems on Clinical Outcomes during the First 12 Months after Primary Total Knee Arthroplasty

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## Abstract

**Background:** Total knee arthroplasty (TKA) is a useful treatment option for advanced knee osteoarthritis. Excellent clinical outcomes after TKA have been widely recognized, but the influence of psychiatric problems on them has not been focused on until quite recently. This study aimed to assess the influence of psychiatric problems on clinical outcomes after TKA in Japanese patients using two assessment scales developed in Japan because the Japanese cultural lifestyle is specifically characterized by bending to the floor and standing up. **Methods:** Clinical outcomes and psychiatric problems were evaluated using the Japanese Knee Osteoarthritis Measure (JKOM) and Brief Scale for Psychiatric Problems in Orthopaedic Patients (BS-POP), respectively. A total of 115 TKA patients were evaluated preoperatively and at 3, 6, and 12 months after TKA. The patients were classified into four groups (groups A-D) based on the BS-POP score. The JKOM scores were then compared between the two groups (groups A and D) with the worst and least psychiatric problems. The JKOM improvement rate between pre- and postoperative status in both groups A and D was also calculated. **Results:** The total JKOM score was significantly poorer in group A than in group D preoperatively and at 3, 6, and 12 months after TKA. The improvement rate showed no significant difference between groups A and D. **Conclusion:** Psychiatric problems influence both the poorer post- and preoperative clinical outcomes. However, a similar improvement rate in both groups A and D has indicated that TKA can be an effective treatment even for patients with psychiatric problems.

## Keywords

Clinical Outcomes, Improvement Rate, Knee Osteoarthritis, Psychiatric

## 1. Introduction

The importance of healthy aging for older people has recently been recognized worldwide. One of the main causes of deteriorating health among the elderly in the orthopedic field is osteoarthritis, especially knee osteoarthritis. Thus, total knee arthroplasty (TKA) is deemed a very useful treatment option for advanced knee osteoarthritis, which severely disturbs the quality of life (QOL) of older patients. In Japan, the estimated number of patients with knee osteoarthritis was reported to be approximately 25 million [1], and about 100,000 TKAs are performed annually. Long-term results of studies with  $\geq 15$  years of follow-up after primary TKA have been reported to show excellent survivorship of  $>90\%$  [2] [3]. Moreover, many excellent mid- and long-term longitudinal assessments have also been published [4] [5] [6] based on patient-reported outcome scales, such as the Western Ontario and McMaster University Osteoarthritis Index (WOMAC) [7], the Medical Outcomes Study 36-Item Short-Form Health Survey [8], the Knee Injury and Osteoarthritis Outcome Score [9], and the Japanese Knee Osteoarthritis Measure (JKOM) [10]. The JKOM was developed as a disease-specific and patient-derived QOL measure for Japanese patients with knee osteoarthritis. It reflects the specifics of the Japanese cultural lifestyle, which is characterized by bending to the floor and standing up.

Some authors have reported that a subgroup of patients had a reduced post-operative improvement in pain, physical functioning, and QOL because of various factors, including sociodemographic (e.g. female gender, older age, and low socioeconomic status) and psychological (e.g. catastrophizing and depressive symptoms, somatization, and patient expectations) factors [11] [12]. In addition, approximately 20% of patients after primary TKA were not fully satisfied with their TKAs [13]. Such discrepancies represent challenging problems in TKA.

Various approaches have already been attempted to improve patient-reported outcomes and patient satisfaction after primary TKA, including changes to implant designs, use of minimally invasive surgical techniques, computer-assisted surgery, and patient-specific cutting guides [14]. Furthermore, various intra- and extra-articular factors that could lead to poorer patient-reported outcomes have been identified (e.g., malposition of components, instability, extensor problems, neurological or vascular disorders, and pathologies of the hip or spine) [15]. Recently, psychiatric problems have received greater attention [14]-[19]. Many evaluation scales for psychiatric problems, such as the pain catastrophizing scale [20], the Eysenck Personality Questionnaire—Brief Version [21], and the Minnesota Multiphasic Personality Inventory-2 [22], have been used. The Brief Scale for Psychiatric Problems in Orthopaedic Patients (BS-POP) was developed in Japan to evaluate psychiatric problems among orthopedic patients in

2011 [23]. The developers of the BS-POP considered that the above scales were difficult to use in routine clinical practice because they contained many questions, were not familiar to orthopedic surgeons, and the interpretation of their data was difficult. Thus, this current study aims to assess the influence of psychiatric problems on clinical outcomes after primary TKA in Japanese patients with knee osteoarthritis using BS-POP and JKOM, both of which have been developed in Japan.

## 2. Patients and Methods

This study enrolled 115 consecutive patients with advanced varus knee osteoarthritis who underwent unilateral primary TKA using a posterior cruciate ligament-retaining or substituting NexGen prosthesis (Zimmer, Warsaw, IN, USA). These TKAs were performed in our clinic by the same surgical team from April 2015 to March 2018. The patients consisted of 20 men and 95 women, with an average age of 72.4 (range, 50 - 87 years) years at the time of surgery. A mid-line longitudinal skin incision and a standard medial parapatellar arthrotomy were used. Bone cuts were performed using a measured resection technique. No patella was replaced. Both femoral and tibial components were fixed with bone cement. No drains were left in the knee joint. A posterior cruciate ligament-retaining and substituting NexGen prosthesis was used in 97 and 18 TKAs, respectively. The study protocol was approved by the institutional review board of the clinic (approval 2014-001). All patients provided written informed consent for the use of the study data.

Clinical evaluations were performed preoperatively and at 3, 6, and 12 months after TKA using the JKOM. The JKOM consists of four subscales (25 items in total): pain and stiffness in the knees (8 items), conditions of daily life (10 items), general activities (5 items), and health conditions (2 items). Each item is scored from 0 (best quality) to 4 (worst quality), resulting in a total score between 0 and 100 (lower scores indicate better QOL) [10].

Preoperative psychiatric problems were assessed by BS-POP [23]. The BS-POP comprises two versions (*i.e.*, one each for the physician and the patient), and the questionnaires have 8 and 10 items, respectively (Table 1 and Table 2). Each item is scored from 1 to 3, resulting in a total score between 8 and 24 (physician version) and 10 and 30 (patient version). Higher BS-POP scores were considered to indicate that the patient had more severe psychiatric problems. Patients with  $\geq 11$  points on the physician version or patients with  $\geq 10$  points on the physician version and  $\geq 15$  points on the patient version were considered to have psychiatric problems [23]. This present study set the cutoff values to identify patients with psychiatric problems as 10 and 15 points on the physician and patient versions, respectively, and further classified the enrolled patients into four groups (A-D). Group A consisted of patients with  $\geq 10$  and  $\geq 15$  points on the physician and patient versions, respectively; group B consisted of patients with  $\geq 10$  and  $\leq 14$  points on the physician and patient versions, respectively; group C consisted

**Table 1.** Physician version in BS-POP (Brief Scale for Psychiatric problems in Orthopaedic Patients) [23].

Questions	Responses and scores		
1) The patient's pain appears uninterrupted	1 That is not the case	2 The pain is intermittent	3 The patient appears to be almost always in pain
2) The patient has a specific way of indicating the symptomatic area (s)	1 That is not the case	2 They rub the symptomatic area (s)	3 Without instruction, they begin to remove their clothes and show the symptomatic area (s)
3) The patient appears to have pain over the whole symptomatic area	1 That is not the case	2 They sometimes do	3 Almost all the time
4) When examination or treatment is recommended, the patient becomes badly tempered, easily angered, or argumentative	1 That is not the case	2 They show slight resistance	3 They show significant resistance
5) When having their senses assessed, the patient responds excessively to stimulation	1 That is not the case	2 Their response is slightly excessive	3 Their response is quite excessive
6) The patient repeatedly asks questions regarding their condition or surgery	1 That is not the case	2 They sometimes do	3 Almost all the time
7) The patient changes their attitude depending on the medical staff member	1 That is not the case	2 They do somewhat	3 They do significantly
8) The patient wishes that their symptoms were gone, even with regard to slight symptoms	1 That is not the case	2 They do somewhat	3 They do significantly

**Table 2.** Patient version in BS-POP (Brief Scale for Psychiatric problems in Orthopaedic Patients) [23].

Questions	Responses and scores		
1) Do you ever feel like crying, or do you cry?	1 No	2 Sometimes	3 Almost all the time
2) Do you always feel miserable and unhappy?	1 No	2 Sometimes	3 Almost all the time
3) Do you always feel nervous and irritated?	1 No	2 Sometimes	3 Almost all the time
4) Do you feel annoyed and aggravated over small things?	1 No	2 Sometimes	3 Almost all the time
5) Do you have a normal appetite?	3 No	2 I sometimes lose my appetite	1 Yes
6) Are you in your best mood in the morning?	3 No	2 Sometimes	1 Almost all the time
7) Do you get somewhat tired?	1 No	2 Sometimes	3 Almost all the time
8) Are you able to put your usual effort into your work?	3 No	2 I sometimes can't	1 Yes
9) Do you feel satisfied with the sleep you are getting?	3 No	2 I sometimes don't feel satisfied	1 Yes
10) Do you have trouble falling asleep for any reason other than pain?	1 No	2 Sometimes	3 Almost all the time

of  $\leq 9$  and  $\geq 15$  points on the physician and patient versions, respectively; and group D consisted of  $\leq 9$  and  $\leq 14$  points on the physician and patient versions, respectively. Thus, groups A and D were considered as the groups with the worst and the least psychiatric problems because these groups showed higher and lower scores in both the physician and patient versions, respectively. Meanwhile, groups B and C were considered to include patients with moderate psychiatric problems because they scored higher on only the physician or patient versions. Groups A, B, C, and D contained 35, 26, 32, and 22 patients, respectively (**Table 3**).

This current study has compared the pre- and postoperative JKOM scores between groups A and D. In addition, the JKOM improvement rate from the preoperative status to the final follow-up point of 12 months after TKA was evaluated. The improvement rate between groups A and D was also compared. The improvement rate was calculated as  $\text{postoperative score} - \text{preoperative score} / \text{full score} - \text{preoperative score} \times 100\%$  [24].

The Mann-Whitney U-test was used in the comparative analysis. P-values of  $< 0.05$  indicated statistical significance. A priori power analysis was performed to determine the preferred sample size for this study. A standard deviation of 10.1 points for the postoperative JKOM score was assumed based on a previous study [4], with a difference of 10 points considered to be clinically significant. Moreover, the power analysis was conducted with the desired two-sided alpha and power of 0.05 and 0.80, respectively. A sample size of 36 knees was required based on these characteristics. Excel Statistics 2008 for Windows (Social Survey Research Information Co., Tokyo, Japan) was used for analysis.

### 3. Results

Patient demographic data including gender, age at the time of surgery, body height, body weight, body mass index, and type of bearing insert used (posterior cruciate ligament-retaining or substituting) are summarized in **Table 4**. No statistically significant differences in patient demographic data exist between groups A and D.

A summary of the comparisons between groups A and D is shown in **Table 5**. Group A represented significantly poorer results compared with group D in total JKOM score and all four JKOM subscales at 3 months after TKA, in total JKOM score and three of four JKOM subscales at 6 months after TKA; and in total JKOM score and one of four JKOM subscales at 12 months after TKA. With

**Table 3.** The enrolled patients were classified into four groups (A-D) based on the BS-POP scores.

	$\geq 15$ points on the patient version	$\leq 14$ points on the patient version
$\geq 10$ points on the physician version	group A (n = 35)	group B (n = 26)
$\leq 9$ points on the physician version	group C (n = 32)	group D (n = 22)

**Table 4.** Patient demographic data.

	group A (n =35)	group D (n = 22)
Gender (male, female)	7, 28	3, 19
Age (yr)	72.8 ± 6.1	73.5 ± 6.2
Height (cm)	152.0 ± 5.4	152.5 ± 6.8
Weight (kg)	59.5 ± 8.5	59.9 ± 7.2
BMI (kg/m <sup>2</sup> )	25.7 ± 2.9	25.7 ± 2.5
type of bearing insert used	32, 3	19, 3

BMI, Body Mass Index; CR, posterior cruciate ligament-retaining; PS, posterior cruciate substituting.

**Table 5.** Comparisons of clinical outcomes at each evaluation point between groups A and D.

	Preoperative			3-month follow-up			6-month follow-up			12-month follow-up		
	group A	group D	p-value	group A	group D	p-value	group A	group D	p-value	group A	group D	p-value
JKOM	49.7	36.1	0.005	27.0	16.3	0.0006	19.3	12.5	0.02	18.3	12.0	0.033
	±	±		±	±		±	±		±	±	
Pain and stiffness in knees	16.7	15.2	0.006	12.2	12.9	0.009	11.2	8.9	0.027	12.8	10.1	0.258
	±	±		±	±		±	±		±	±	
Condition in daily life	18.0	12.7	0.005	8.2	4.9	0.003	5.8	3.2	0.005	3.7	2.6	0.015
	±	±		±	±		±	±		±	±	
General activities	5.9	6.1	0.38	4.7	5.0	0.04	4.7	3.4	0.773	3.8	3.0	0.65
	±	±		±	±		±	±		±	±	
Health conditions	10.2	9.2	0.016	7.3	4.5	0.016	4.8	4.4	0.011	4.7	3.7	0.266
	±	±		±	±		±	±		±	±	
	5.4	4.2		5.4	4.6		4.4	4.4		4.9	4.0	
	1.3	0.6		0.7	0.3		0.6	0.1		0.7	0.4	
	±	±		±	±		±	±		±	±	
	1.2	0.9		1.0	0.9		1.0	0.2		1.3	0.6	

JKOM, Japanese Knee Osteoarthritis Measure.

regard to preoperative comparisons, group A showed a significantly poorer total JKOM score and three of four JKOM subscales compared with group D.

The JKOM improvement rate in groups A and D was 64.0% ± 22.9% and 62.1% ± 26.9%, respectively. No statistically significant difference was noted in the JKOM improvement rate from the preoperative status to the final follow-up at 12 months after TKA between groups A and D ( $p = 0.99$ ).

#### 4. Discussion

Because the Japanese people have a specific cultural lifestyle compared with Western people, we evaluated the surgical outcomes of TKA patients using JKOM and BS-POP, both of which have been developed in Japan and can assess the Japanese patients more appropriately than other assessment scales developed in for-

eign countries. This current study clarified several findings. First, group A (considered the group with the worst psychiatric problems) had poorer postoperative clinical outcomes evaluated by total JKOM score and JKOM subscales compared with group D (considered to be the group with the least psychiatric problems). Second, group A showed a significantly poorer total JKOM score and three of four JKOM subscales preoperatively compared with group D. Finally, no statistically significant differences in the JKOM improvement rate were noted from the preoperative status to the final follow-up at 12 months after TKA between groups A and D.

The analysis of JKOM subscales was also interesting. In the comparison of pre- and postoperative outcomes of JKOM subscales between groups A and D, p-values of “general activities” were higher than those of the other three subscales (**Table 5**). Although the exact explanation is obscure, this fact may indicate that patients with more severe psychiatric problems have more complaints about “pain and stiffness in knees” and “condition in daily life,” but can perform “general activities” on a level with those without psychiatric problems. Further examinations are necessary to clarify whether there are differences in the comparisons of objective and subjective outcomes between patients with and without psychiatric problems.

Many psychological factors relate to persistent pain, clinical outcomes, and patient satisfaction after TKA [15] [16] [17] [18] [19]. Sullivan *et al.* [16] reported that pain catastrophizing predicted follow-up pain and function. Gong and Dong [17] showed that the patient’s personality, as evaluated using Eysenck Personality Questionnaire, predicted recovery after TKA. In their systematic review and meta-analysis, Sorel *et al.* [19] concluded that preoperative pain catastrophizing, mental distress, anxiety and/or depression symptoms, and somatoform disorders appeared to adversely affect pain and function after TKA. These authors assessed the influence of psychiatric problems only on postoperative outcomes.

Some authors described the influence of preoperative psychiatric problems not only on the postoperative outcomes but also on the preoperative characteristics, such as QOL, knee pain, and function [15] [18] [25] [26]. Hirschmann *et al.* [15] reported that more depressed patients showed poorer postoperative WOMAC scores. However, they also pointed out that a similar finding was already found for preoperative scores and no difference was noted in amelioration, which was evaluated by net changes from pre- to postoperative WOMAC scores. Halawi *et al.* [18] examined the effect of depression on patient-reported outcomes, the WOMAC scores, after total joint arthroplasty, wherein they concluded that significant improvements in WOMAC scores of patients with depression were expected postoperatively, and the effect of depression on patient-reported outcomes was less pessimistic than previously thought. Similar findings were derived from this current study. Group A was found to show a significantly poorer JKOM score compared with group D post- and preoperatively. Furthermore, no statistically significant differences were noted between groups A and D in the

JKOM improvement rate from the preoperative status to the final follow-up point of 12 months after TKA. Therefore, patients with psychiatric problems should be expected to improve their knee symptoms by TKA similar to those without psychiatric problems, although psychiatric problems may influence both the poorer post- and preoperative clinical outcomes.

Many authors who examined the relationships between psychiatric problems and pre- and postoperative clinical outcomes emphasized the importance of preoperative psychiatric screening and subsequent psychological support to gain better recovery. However, Jacobs *et al.* [14] concluded that dissatisfaction after TKA was a complex problem requiring multidisciplinary approaches. Therefore, many interventions including intraoperative factors, prosthetic design, rehabilitation, psychological screening, and supportive treatments before TKA should be further researched, developed, and tested to reduce persistent pain and improve patient-reported outcomes and patient satisfaction after TKA.

This current study has three limitations. The first limitation is that the follow-up period was relatively short. However, we believe that a follow-up period of 12 months is sufficient, considering that Sugita *et al.* [4] previously reported that improvements in both JKOM and objective outcomes reached a plateau 1 year after TKA and lasted for  $\geq 5$  years. Nevertheless, further investigations are needed to clarify the influence of psychiatric problems on clinical outcomes with longer follow-up periods. Second, other factors (e.g. comorbidities, medications, and sarcopenia) were not taken into consideration while evaluating clinical outcomes. These factors may also affect the outcomes. Finally, only 20 of 115 patients (17.4%) were male in the current study. The prevalence rate of male patients may appear to be small. However, it was assumed based on epidemiological data in Japan that 2,200,000 men (28.2%) and 5,600,000 women (71.8%) aged 40 years and older would be affected by symptomatic knee osteoarthritis [1]. In addition, the prevalence rate of male patients in three follow-up studies [4] [27] [28] after TKA reported in Japan was 12.3% (16 of 130 patients), 14.1% (11 of 78 patients), and 24.4% (10 of 41 patients).

## 5. Conclusion

In conclusion, this is the first study to demonstrate that psychiatric problems affected not only postoperative outcomes but also preoperative evaluations in TKA surgery using clinical and psychiatric scales developed for Japanese patients. Of course, poorer postoperative outcomes may be partly influenced by poorer preoperative ones in patients with psychiatric problems. However, TKA should be effective even for those with psychiatric problems. Thus, further studies with more patients, more follow-up periods, and more clinical and psychiatric scales are necessary to clarify the detailed relationship between psychiatric problems and clinical outcomes before and after TKA.

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## Conflicts of Interest

The authors declare no conflict of interest regarding the publication of this paper.

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